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Radu Gheorghiu

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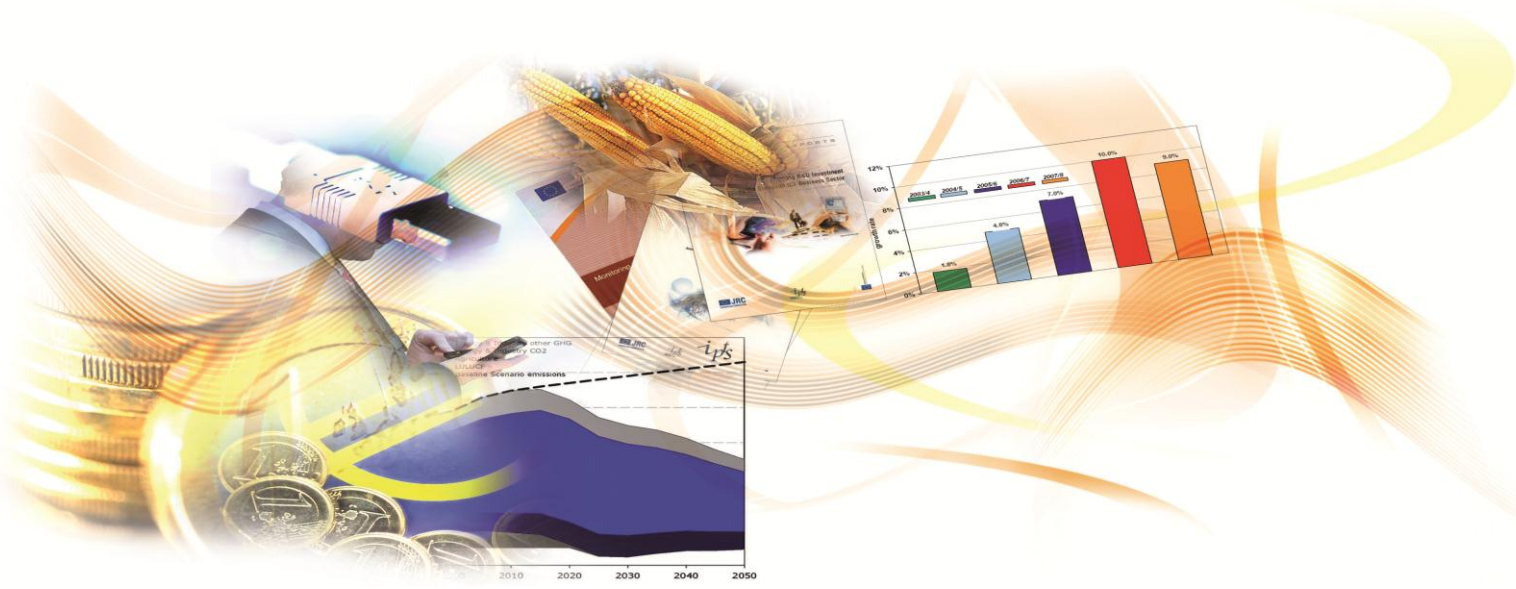

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Abstract

The Analytical Country Reports analyse and assess in a structured manner the evolution of the national policy research and innovation in the perspective of the wider EU strategy and goals, with a particular focus on the performance of the national research and innovation (R&I) system, their broader policy mix and governance. The 2013 edition of the Country Reports highlight national policy and system developments occurring since late 2012 and assess, through dedicated sections:

- national progress in addressing Research and Innovation system challenges;
- national progress in addressing the 5 ERA priorities;
- the progress at Member State level towards achieving the Innovation Union;
- the status and relevant features of Regional and/or National Research and Innovation Strategies on Smart Specialisation (RIS3);
- as far relevant, country Specific Research and Innovation (R&I) Recommendations.

Detailed annexes in tabular form provide access to country information in a concise and synthetic manner.
The reports were originally produced in December 2013, focusing on policy developments occurring over the preceding twelve months.

ACKNOWLEDGMENTS AND FURTHER INFORMATION

This analytical country report is one of a series of annual ERAWATCH reports produced for EU Member States and Countries Associated to the Seventh Framework Programme for Research of the European Union (FP7). ERAWATCH is a joint initiative of the European Commission's Directorate General for Research and Innovation and Joint Research Centre.

The Country Report 2013 builds on and updates the 2012 edition. The report identifies the structural challenges of the national research and innovation system and assesses the match between the national priorities and the structural challenges**,** highlighting the latest developments, their dynamics and impact in the overall national context.

The first draft of this report was produced in December 2013 and was focused on developments taking place in the previous twelve months. In particular, it has benefitted from the comments and suggestions of Mariana Chioncel from JRC-IPTS. The contributions and comments from DG-RTD and from Rolanda Predescu (General Director, Ministry of National Education (MNE), Directorate General R&D Programmes), Viorel Vulturescu (MNE, Director, Directorate General R&D Programmes, Directorate Programs for European and International RDI Priorities), Alexandra Vancea (Counsellor for European Affairs, MEN-Directorate General R&D Programmes, Directorate Programs for European and International RDI Priorities, Beatrice Paduroiu (Counsellor for European Affairs, MEN-Directorate General R&D Programmes, Directorate Programs for European and International RDI Priorities) are also gratefully acknowledged.

The report is currently only published in electronic format and is available on the ERAWATCH website. Comments on this report are welcome and should be addressed to jrc-ipts-erawatch-helpdesk@ec.europa.eu.

EXECUTIVE SUMMARY

Romania is the 7th largest country in terms of population in the EU with estimated 21.35m inhabitants in 2012 (Eurostat). The GDP per capita in PPS in 2012 is half of the EU28 average (while in euro, it is four times lower than the EU average) and 70% of the average GDP per capita of the new EU Member States. Further discrepancies lie between the eight regions, Bucharest registering more than double GDP per capita compared with the next region (i.e., West Region) and four times as the region with the lowest level (i.e., North East) (2010, NIS data).

The structure of the economy is considerably different from the EU average, as agriculture represents 32% of employment (compared to 5% EU average), services only 39% (compared to 72% EU average), while the employment in manufacturing is slightly closer to the EU average (28% compared to 23%) (Eurostat data 2011).[1]

Of the 8.365m jobs in Romania only just over 4m jobs are salaried. The very high level of self-employment (2.1m, 25% of all jobs) is more associated with subsistence agriculture and a lack of alternatives rather than with entrepreneurship. A further 1.4m (20% of all jobs) are unremunerated family labour, a category that barely exists in the more developed economies of the EU (Partnership Agreement, p.11)

Romania is classified as an efficiency-based economy, while most of the EU countries are either innovation-based or in transition towards an innovation-based economy (Global Competitiveness Report 2012-2013). The Romanian economy is dominated by multinationals and several state owned companies, while SMEs are mostly in low value-added activities and with very limited global perspective.

Institutional challenges and the large grey economy are reflected in the low capacity of absorbing structural funds, of developing the transport infrastructure, or tapping the huge potential of the agriculture.

The public R&D expenditure remains below 0.3%, while BERD decreased gradually to only 0.12% in 2012. Putting this into the context of the GDP gap, Romania has R&D expenditures per capita 19 times lower than the EU average. At this level, one cannot expect the RDI system to be a real driver for the economy.

Given that the number of researchers (FTE) per population is four times less than the EU average, for a reasonable comparison the productivity per researcher needs to be considered. Hence, the number of international scientific co-publications per researcher in Romania is double of the EU average, while the number of PCT patents per researcher is four times below the EU average.

The official target of 1% of GDP public expenditures has been reiterated, but is continuously postponed for implementation. A vicious circle has been created: the chronically underfinanced RDI system does not reach the critical mass (and critical time) for technology development, while the low economic impact further restrains the allocation of public funds.

An RDI Strategy and Plan have been in place for 2007-2013, a strategy meant as a transition from a subsistence system towards a mature one (based on the gradual reaching of 1% of GDP

1 Employment includes "persons who during the reference week performed work, even for just one hour a week, for pay, profit or family gain" (Eurostat). In agriculture only a small fraction of employment (1/7 according to Albu et al, 2012) are employees, the rest being family workers, self-employed or employers.

public expenditure by 2010). With a broad spectrum of instruments for the entire value chain and considerable investment in infrastructure and human resources (supported also by structural funds), the strategy and its main implementation instrument have received only one third of the programmed budget. The underfinancing, which took the form of unpredictable cuts, has created difficulties in multiannual planning and structural unbalances (e.g., between infrastructure investment and project funding, or between the investment in human resources and the absorption capacity of the system).

An important decision has been taken for the investment in the pan-European infrastructure ELI-NP near Bucharest, Romania being the first country to use the structural funds for this purpose. However, instead of reallocating more structural funds for R&D (from other priorities, where the SF were not absorbed), the investment reduced the room for project funding in 2012 and 2013.[2] For the period 2014-2020 Romania has again allocated from the SF less than one billion euro for RDI, which would mean that in the official scenario of reaching 1% of GDP by 2020, the SF would cover only 15%, the rest being supported by the state.

An important indirect funding has been introduced in 2010 with the R&D tax deduction of 20%, raised in 2013 to 50%. However, in the period 2010-2012 BERD further declined. The informal feedback from the private actors shows that the 20% tax deduction has not been a practical one, both in bureaucratic terms and in its multiannual format of deductibility, and the 50% introduced by law in 2013 has de facto stopped the 20% scheme, as the new implementation norms have not been released yet.

The 50% tax deduction represents a strong leverage for the future involvement of companies in R&D, but given the type of competitiveness of Romanian SMEs, the activation of the private investment in RDI requires time, policies for supporting their globalisation and advancement along global value chains and the development of PROs capable of becoming partners for the Romanian companies.

For the period 2014-2020 the draft RDI Strategy and its main implementation instruments have been again elaborated under the assumption of reaching 1% public expenditure by 2020, with an associated target of 1% private investment. With a vision which stresses the role of R&D competitiveness, the new Strategy proposes: a stimulating environment for private sector initiative (e.g., venture capital, credit guarantees, full implementation of the tax deduction), a spectrum of instruments in support of smart specialization (e.g., R&D projects for different phases from ideas to market, long term public-private projects, commercialisation support, tech transfer infrastructure), activation of public demand, integration of the fundamental research into international communities, and institutional R&D funding based on performance (including universities, which do not have special research funding at the moment).

Most of the actions are directly reflected in the draft implementation instruments (i.e., National RDI Plan and Operational Programme), but some of the action lines need further governmental policies (e.g., public procurement for innovation) or simply additional reforms (e.g., the restructuring of public R&D institutes).

The priorities for 2014-2010 have been elaborated in a process combining evidence-base building and large participatory foresight. The resulting four specializations are: *Bioeconomy* – which builds on the huge agriculture potential, the correlated food industry and the tradition in pharmaceuticals; *ICT, Space and Security* – ICT being one of most dynamic industries in Romania; *Energy, Environment and Climate Changes* – with a stress on reducing energy dependency, increasing energy efficiency, management of water resources, and the intelligent city; and *Eco-Nano-*

[2] For the period 2007-2013 Romania allocated only €100m per year for R&D, most of these dedicated initially for projects. In the years 2012 and 2013 the allocation of SF for ELI construction has not been compensated by the governmental R&D budget or by reallocation of SF from fields with considerable lower absorption rates.

Technologies and Advanced Materials – which support the competitiveness of the significant automobile industry and the still-promising industry for agriculture equipment, but also depolluting and waste technologies and new materials. In addition to the smart specializations, which are understood as having a strong commercialisation orientation, the RDI Strategy proposes three other priorities for the public sector: *Health, Heritage and Cultural Identity* and *New and Emerging Technologies*.

Reaching the ambitious targets of the new strategy (among which 1% BERD, doubling the number of researchers by 2020 and simultaneously reaching 45% of all researchers in the business sector) are highly dependent on predictable financing. Unfortunately, the budget allocations for 2014 and 2015 are not in the trend path for reaching the 1% target.

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1. BASIC CHARACTERISATION OF THE RESEARCH AND INNOVATION SYSTEM

The Romanian research and innovation system is under-dimensioned in relation with the country population. The number of researchers (FTE) per population is four times below the EU average, and only 21% of these researchers were active in the business sector in 2011 (compared with 45% EU average in 2011, Eurostat).

The National RDI Strategy 2007-2013 had, as one of its key objectives, reaching the EU average in researchers per population, but as the allocated budget was only one third of the programmed one, the objective has been de facto abandoned. For the period 2014-2020 the new objective in terms of researchers is to double their number and simultaneously reach 45% in business sector (i.e. the number of researchers in business should increase four times).

The main research organizations are the national R&D institutes, most subordinated to the Ministry of National Education (MEN), the institutes of the Romanian Academy and branch academies, and the universities. In what regards the latter, the R&D activities are rather occasional, related to the oscillating project funding and/or the publishing efforts in relation to the academic career[3].

The credit granting institutions are the:

- *Ministry of National Education – MNE* and its agencies (78% of public budget in 2013*)*
  - *The Executive Agency for Higher Education, Research, Development and Innovation Funding* (UEFISCDI), subordinated to MEN, is the implementing agency for the National RDI Plan 2007-2013, a set of project-based funding schemes with a structure and procedures very similar to FP7 (i.e., the programmes Ideas, Human Resources, Partnerships, Innovation, Capacities), open for all the RDI actors.
  - *MNE* implements the programme Nucleu, a project-based institutional funding instrument for the National R&D Institutes.
  - *The Intermediary Body for RDI*, coordinated by MNE, implements the operational programme for RDI structural funds 2007-2013.
- *Romanian Academy* - which has its own chapter in the national budget (18% of the public R&D expenditures in 2013), allocates the budget for its research institutes.
- *Ministry of Economy* (2% of budget in 2013) manages its sectoral RDI programme;
- *Ministry of Agriculture* (2% of budget in 2013) manages its sectoral RDI programme;

The Ministry of National Education (MNE) coordinates the National RDI Strategy, the National RDI Plan and the RDI structural funds, and advises on the sectoral RDI programmes of ministries, but has no role in the coordination of the programmes of the Romanian Academy, and has a still weak influence on the broader innovation support policies.

The innovation policies do not have de facto inter-ministerial coordination, as the responsible body at governmental level (i.e., The National Council for Science and Technology Policy - NCSTP) remains inactive. Therefore, Research & Innovation is still a sectoral issue in Romania.

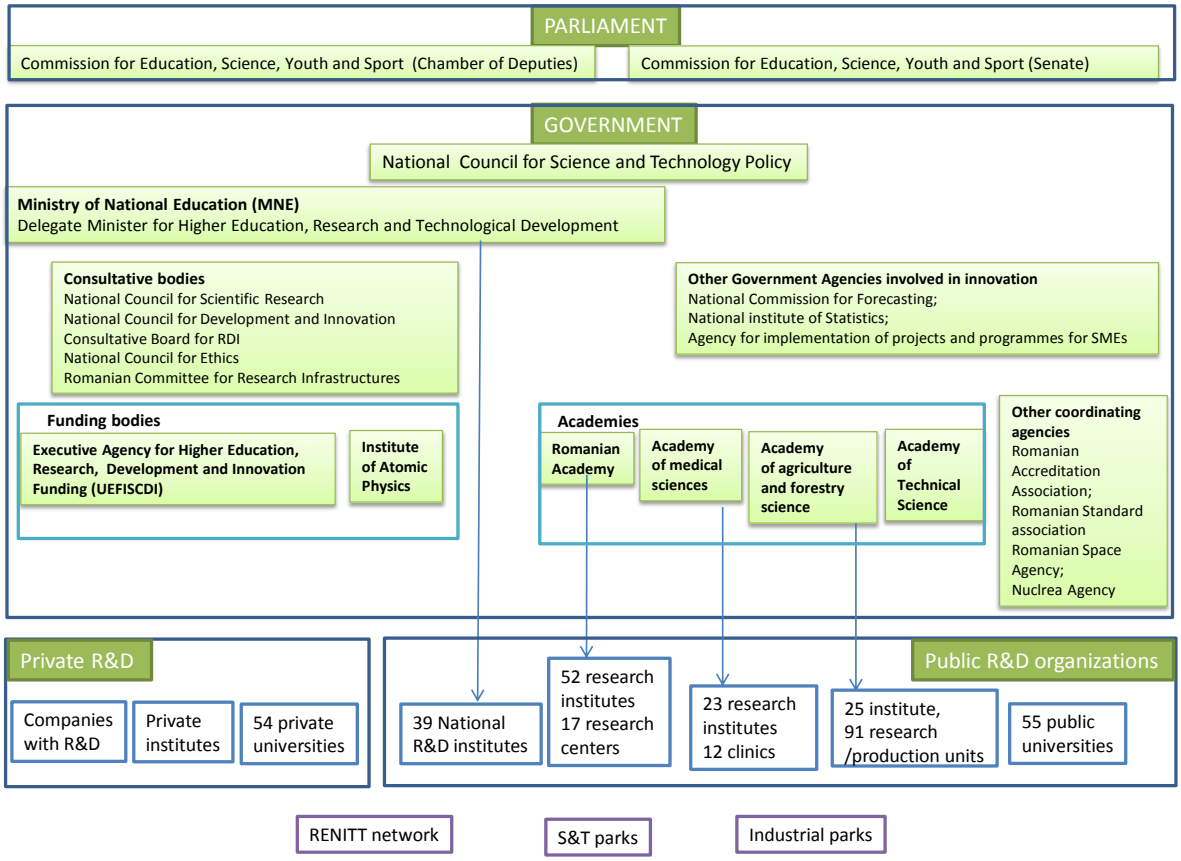
The National Strategy and Plan 2007-2013 should be in place by June 2014. In the meantime, a complete strategic package has been elaborated[4], including the National RDI Strategy 2014-2020 (NS) and its main implementation instruments: The National RDI Plan 2014-2020 (NP3), for the

[3] In the statistics the number of researchers from universities is estimated simply as equivalent of 25% of academic staff.

[4] More details about the elaboration process can be found at www.cdi2020.ro

allocation of governmental funds, and the Operational Programme for RDI structural funds (OP). The three documents are in the phase of final consultations.

Figure 1. Overview of Romania's R&D system governance structure



With a vision which stresses the role of R&D-based competitiveness, the new draft strategy (expected to be launched in May 2014) proposes: a stimulating environment for private sector initiative (e.g., venture capital, credit guarantees, full implementation of the tax deduction package), a spectrum of instruments in support of smart specialization (e.g., R&D projects for different phases from ideas to market, long-term public-private projects, commercialisation support, tech transfer infrastructure), activation of public demand, integration of the fundamental research into international communities, and institutional R&D funding based on performance (including for universities, where at present the institutional funding is only related to teaching, with no R&D component).

The programme *Thematic projects* cumulates 50-70% of NP3 (with a broad spectrum of financing schemes for frontier research, translational research, prototype development, centres of competence, solutions for the public or private sector). The other programmes are intuitively called *International, Institutional* (institutional financing for all actors, including universities, and also the implementation of the National Roadmap of Infrastructures), and *Support*. OP includes a broad set of instruments complementary to NP3, some of them new in the Romanian R&D landscape, with an even stronger innovation orientation: venture capital funds, credit guarantees, credits with subsidised interests, inter-sectoral mobility schemes, schemes for attracting international talents, tech transfer partnerships. The investment in large R&D infrastructures (including ESFRI) is also supported by OP.

The prioritisation is clear in both NP3 and OP, as they clarify the application of each scheme to the identified smart specializations, national priorities or fundamental research.

While the RDI policies and competitions remain at central level, the development of tech transfer infrastructure during the period 2014-2020 will be supported by the Regional Operational Programme. A special case for the implementation is agriculture, a dedicated budget for agriculture R&D being allocated through the specific operational programme.

2. RECENT DEVELOPMENTS OF THE RESEARCH AND INNOVATION POLICY AND SYSTEM

2.1. National economic and political context

Romania has one of the lowest GDPs in Europe: GDP per capita in PPS was 12600€ in 2012, compared with 25500€ EU28 average (Eurostat).Romania is the country with the largest share of rural population in Europe: in 2012, 43% of the population lived in thinly-populated areas, compared with 28% EU average (Eurostat).

The economic growth for 2013 was 3.5% (according to International Economic Unit, September 2013), and estimated at 2.3% for 2014 and 2.5% in 2015 (Winter Forecast of the National Commission for Prognosis).

The commercial deficit decreased in the first eight months of 2013 by 40%, compared with the same period of 2012. The main driver is the increase of exports by 7.9%. Transport vehicles and equipment represents a considerable part of both exports (42%) and imports (34.6%) (NIS).

Romania dropped a place in the Global Competitiveness Report 2012-2013 and now ranks 78 out of 144 countries. The country is classified as an efficiency-based economy, while most of the EU countries are either innovation-based or in transition towards an innovation-based economy.

The absorption rate for the European funds reached 19% in August 2013 (Ministry of European Funds). The still very low value represents a considerable increase compared with the one registered in 2012.

Regionalisation, which has been highly acknowledged among others as a means to increase the absorption of structural funds, is still delayed. In January 2014, the proposed law for regionalisation was returned to the Parliament by the Constitutional Court of Romania for reasons related to the principles of autonomy and property rights. Under these circumstances, regionalisation will require a change in the constitution.

The Foreign Direct Investments also remain very low, with net inflows slightly above €2b, out of which only €18m in greenfield investments (National Bank, *FDI in Romania in 2012*). Unfortunately, the share allocated from the national budget for investments is also quite small (only 16.6% in 2013).

The accession of Romania to Schengen has been delayed, with the delay being motivated formally by the poor quality of frontier protection and less formally by the risk of immigration and especially immigration for taking advantage of social protection.

The year 2013 also marked two failed privatisations: of the Oltchim (a chemical company) and CFR Marfa (the national railways transport company for freight). Both companies faced increasing debts in the last years after being profitable before the crisis.

The society has been polarised in 2013 by two cases of resource exploitations: gold mining with cyanide and shale gas. The street demonstrations have for the moment blocked the two exploitations but the resolutions are still pending.

In terms of energy, last years' explorations confirmed large gas resources in the Black Sea, which may ensure energy independence and even exports in the future. At the same time, the Romanian Government decided to reduce the quite high subsidies for wind energy granted in the last years.

2013 represents also the most active year in the fight against high-level corruption: a large number of VIPs, including ministers and ex-ministers, being prosecuted or convicted for corruption.

Romania negotiated with the EC and the IMF a precautionary economic adjustment programme in 2011. After the successful completion of the programme, Romania signed in September 2013 a new 24-month Stand-By Arrangement in an amount equivalent to SDR 1.75 billion (about €1.98b). The authorities have informed the IMF that they intend to treat the new arrangement as precautionary, and therefore do not plan to draw under it. The authorities have also requested precautionary support from the European Union of €2b.[5]

In November 2013, following the visit of the Chinese Prime-minister at the summit East and Central Europe-China held in Bucharest, Romania and China signed a set of economic partnerships which include the creation of a new technology park, Romanian export of breeding cows and pork, the cooperation in the field of energy and high-speed train transport.

2.2. Funding trends

2.2.1 Funding flows

R&D expenditure in Romania in euro per capita is 19 times smaller than the EU average. This is partly the effect of public expenditures maintained at a quarter of the official target of 1% of GDP and of business expenditure declining to only 0.12% of GDP, all in the context of the huge GDP gap vis-à-vis the EU average.

The official target of 1% public R&D expenditures (complemented with 2% private) was first set in 2006 and was used as a basis for the programming period 2007-2013, but the reality showed an average annual allocation for the National Plan three times smaller. Romania has again reaffirmed the objective of 1% public (this time with 1% private) for 2020, and these figures were considered as the basis for the National RDI Strategy 2014-2020 and its main implementation instruments.

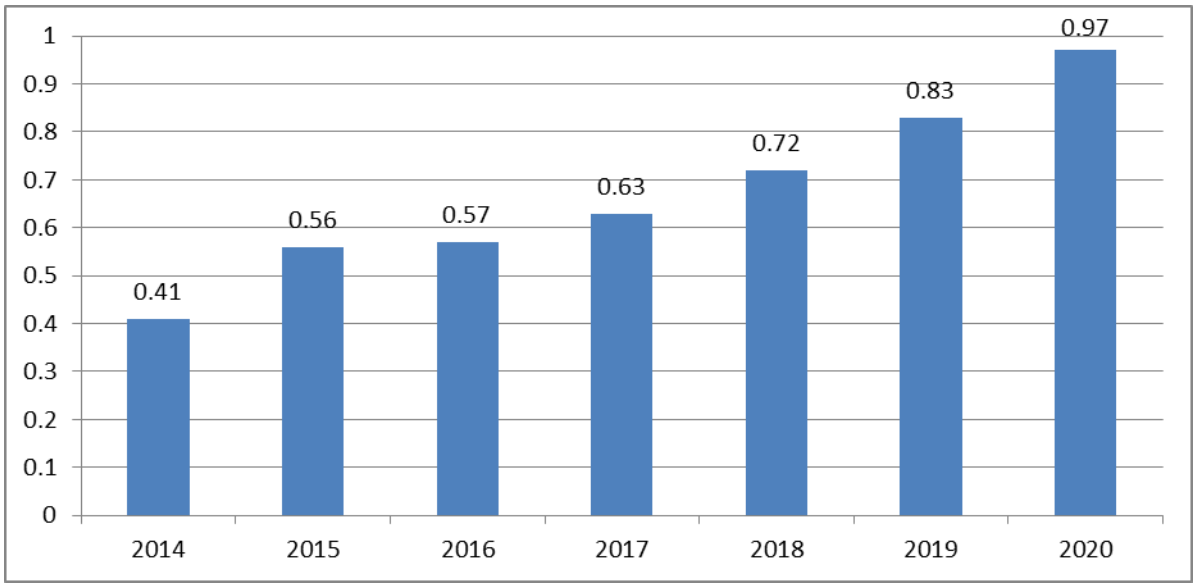
Unfortunately, the very limited governmental R&D expenditures in 2012 and 2013, along with the further postponing of an increase (in 2014 the budget is practically the same, although the 1%+1% targets were reiterated in the Budgetary and Fiscal Strategy) creates not only a lack of trust, but tensions in multiannual planning, with cuts in projects already underway and delays for new competitions. As a response to this situation, all the members of the National Council for Scientific Research (NCSR) resigned on 12 April 2013 and their places are still vacant.

An yearly planning for R&D public expenditure for the entire period 2014-2020 was elaborated by MNE as an annex to the National RDI Strategy 2014-2020 (see Figure 2), but the allocations for the years 2015-2016 as specified in the Fiscal and Budgetary Strategy 2014-2016 or the Law of the National Budget 2014 (Law 356/ 19 December 2013) specifies in fact a reverse trend (see

5 http://www.imf.org/external/np/sec/pr/2013/pr13367.htm

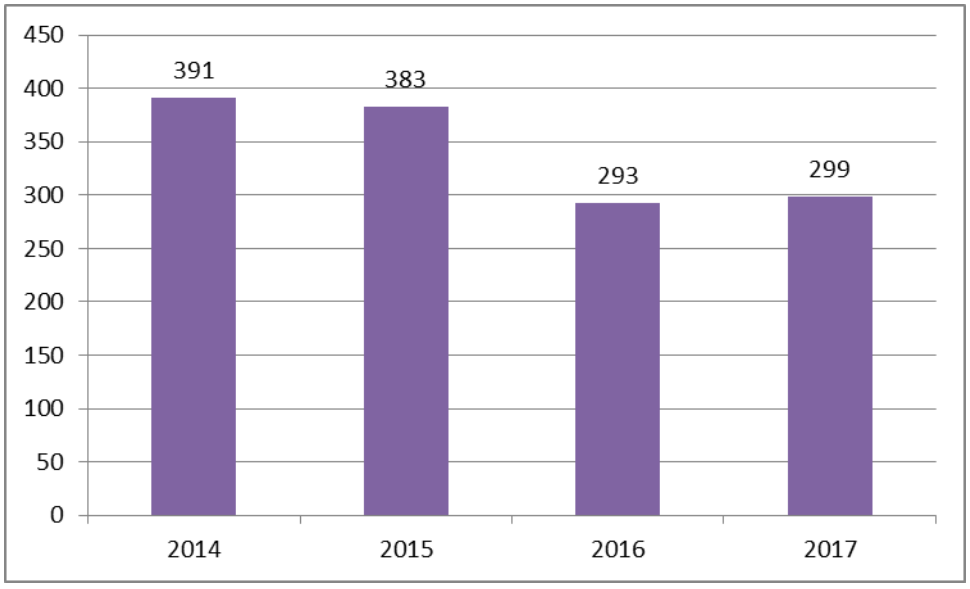
Figure 3). At the same time, the structural funds for R&D allocated for 2014-2020 will most likely be comparable with the previous cycle of €700m, which means that the target is highly dependent on the governmental resources (SF would cover only 10% of the envisaged public R&D expenditures).

Figure 2. The multiannual planning for the public R&D expenditures 2014-2020 proposed by MNE (% GDP)



Source: MEN, annex of the draft National RDI Strategy 2014-2020, April 2014.

Figure 3. The estimated public R&D expenditures 2014-2017 in the 2014 State budget (mil. Euro)



An important investment decision has been made related to the construction of the Romanian component ELI-NP (Extreme Light Infrastructure – Nuclear Physics) of the pan-European research infrastructure ELI, which is included in the ESFRI list (€280m from SF and €60m from the state budget).

As for BERD, already at low level in 2012, a further decrease was registered in 2013, down to 0.12% of GDP, despite the fact that the 20% tax deduction for R&D had been in place for 2011 and 2012. Further analyses are needed to show whether the cause is related to the disappearing of some key players (e.g., two companies in the top 5 Romanian R&D Scoreboard 2010 (see Ciupagea et al. 2011), Nokia left Romania, while Oltchim is almost bankrupt), to the reduction of the budgets in co-financing schemes in the RDI Plan, or to the broader economic transformations following the economic crisis.

Table 1. Basic indicators for R&D investments

	2009	2010	2011	2012	EU27 (2012) **
GDP growth rate	-6.6	-1.1	2.2	0.7	- 0.4
GERD (% of GDP)	0.47	0.46	0.5	0.42*	2.06
GERD (euro per capita)	27.2	28.2	32.5	27.6	525.8
GBAORD – Total R&D appropriations (€ million)	360.4	353.2	352.8	290.5	90344.8
R&D funded by Business Enterprise Sector (% of GDP)	0.16	0.15	0.19	0.12	1.12(2011)
R&D performed by HEIs (% of GERD)	25%	25%	23%	23%	24%
R&D performed by Government Sector (% of GERD)	35%	37%	41%	48%	12%
R&D performed by Business Enterprise Sector (% of GERD)	40%	38%	36%	29%	63%
Share of competitive vs. institutional public funding for R&D		74% /26%	72%/18 % (69%)	66% (34%)	
Venture Capital as % of GDP	0	0	0	0	0.035 (EU15)
Employment in high- and medium-high-technology manufacturing sectors as share of total employment	4.6	4.4	4.7	4.6	5.6 (2011)
Employment in knowledge-intensive service sectors as share of total employment	19.8	19.9	20.6	20.3	39 (2011)

*** Definition differs**

In late 2011, four financial instruments for SMEs in Romania were introduced under the European JEREMIE initiative: three guarantee funds and a venture capital fund, all contracted with financial intermediaries. Their first assessment indicates difficulties in implementation, particularly due to European rules of eligibility, negotiations with private investors and to bureaucratic overload (Lucaciu 2012).

Given the very low level of R&D expenditure per capita, one can estimate that the R&D is not a driver for the high-tech industry, but more likely the low presence of the high-tech industry limits BERD.

2.2.2 Funding mechanisms

2.2.2.1. Competitive vs. institutional public funding

Institutional funding is limited to:

- the Romanian Academy, which receives a relatively constant amount (highly correlated with the number of researchers), which in the low total national budget for 2013 represented 18%.
- the financing for National R&D Institutes, through the Nucleu programme. Each institute has its own Nucleu programme (portfolio of projects), reflecting the specific R&D strategy of the institute, also including objectives related to the development of the economic sector/ branch corresponding to the institute's profile. The funding decision taken by MNE reflects a prioritisation of those specific Nucleu programmes, based on the joint analysis of the previous performance of the institutes and the relevance of their R&D portfolio as compared to the development priorities of the corresponding sector/branch. For the period 2014-2020, the institutional funding principles expressed in the NS attempts to correlate the funding for national R&D institutes, Romanian Academy institutes and universities. A dedicated programme for institutional funding has been included in the NP3, which can de facto integrate the resources now spent through Nucleu programme and add a similar stream for universities, in correlation with the financing stream of the Romania Academy.

A financial simulation shows that in the scenario of 1% of GDP public expenditure in 2020, and considering the budget for the Romanian Academy and national R&D institutes increase by then by 25% in real terms, while universities receive a similar amount with national institutes, the total institutional funding would represent in 2020 15% of the national R&D budget.

An evaluation procedure for the "entities part of the national RDI system" has been adopted by Governmental decision 1062/October 2011. The procedure involves panels where the members are selected on the basis of highest international standards and at least half of them are from abroad. It was first launched for national R&D institutes. The partial results show that out of 32 institutes evaluated in 2012, 31% are classified as "A+", 45% as "A" and 24% "A-", and none was classified B or C, which means none is subject for reorganisation, consolidation or closure. The final aim of the evaluation process is to establish a direct correlation between evaluation results and the volume of institutional funding, which was not yet accomplished.

2.2.2.2. Government direct vs indirect R&D funding[6]

The Order 2086/4504/August 2010 of the Ministry of Finance and the Ministry of Education, Research, Youth and Sport (as it was then called) introduced a tax deduction for R&D expenditure of 20%, alongside the accelerated depreciation of R&D equipment. According to the

[6] *Government direct R&D funding* includes grants, loans and procurement. *Government indirect R&D funding* includes tax incentives such as R&D tax credits, R&D allowances, reductions in R&D workers' wage taxes and social security contributions, and accelerated depreciation of R&D capital.

feedback of some business representatives the tax deduction in its 2010 form involved bureaucracy and it was also not very practical because of its multiannual deductibility.

The tax was changed in 2013, theoretically raised to 50% (Governmental Ordinance 8/2013) and with a broader spectrum of deductible activities. However, the new governmental ordinance introducing the 50% tax deduction was released in January 2013, and the application norms for the new one have not been issued one year later. Therefore in 2013 no tax deduction has been de facto in place.

For the RDI project funding 2014-2020 the NP3 and OP cover the

a) *The value chain from idea to the market*, through the following financing line:
- "Frontier" (NP3) – supports fundamental and exploratory research, with large involvement of PhD students,
- "Concept" (NP3) – supports technology development up to the phase of laboratory tests;
- "Prototype" (NP3) – supports prototype development for the technologies with commercialisation potential;
- "Commercialisation projects" (OP)

b) *Not only supply, but also demand-driven projects*:
- "Solutions" – calls for projects with demand formulated in the public sector, the beneficiaries being involved in the selection of projects and validation of results;
- "Innovation contracts" – a kind of innovation vouchers;

c) *Different forms of public-private partnerships* (in addition to project consortia):
- "Competence centres" (NP3)– co-financing up to 50% of 5-7 years long projects in public-private partnerships;
- "Tech transfer partnerships" (OP);
- "Temporary transfer of researchers towards the SMEs sector" (OP);

d) Internationalisation
- "Institute of Advanced Studies" (NP3) – the first Romanian fellowship programme;
- Participation in international programmes (NP3);
- "Projects with international leading scientists" (OP);

e) Instruments stimulating private initiative
- Venture capital for SMEs (OP);
- Credits with subsidised interest rates (OP);
- Guarantees for technological risk (OP).
-

2.2.3 Thematic versus generic funding

For the period 2007-2013, in a way similar to FP7, the thematic funding of the National Plan was concentrated in the programme Partnerships, which accounted for more than 50% of the funds. The priorities of the programme resulted from a large foresight carried in 2006. The programme Partnerships included structural financial allocation for the priorities, an idea that was later abandoned due to highly unbalanced success rates between the fields. The RDI Operational Programme 2007-2013 had an indicative list of industries as priorities, but faced low demand from these industries and was eventually implemented as a non-prioritised scheme.

For the period 2014-2020, the large national foresight carried carried in 2013 resulted in the identification of four smart specialisations (which have a set of associated sub-fields) and three national priorities (i.e., fields with less commercialisation potential). The eligibility from the area

of smart specialisation and/or national priorities is specified for each of the financing lines of the NP3 and OP.

2.3. Research and Innovation system changes

In December 2013 the Delegate Minister for Higher Education, Scientific Research and Technological Development announced that starting 2014 the financing system for universities will be again the older one based on "quality indicators"[7]. The measure comes after the system implemented in 2011 and 2012, which was based on university classification and programme rankings, was contested by several universities, especially in what regards the lack of transparency (Hotnews 23 December 2013). However, following a lawsuit between the Suceava University and MNE, in April 2014, the High Court of Cassation and Justice declared the system of university classification and programme rankings legal (Hotnews, 11 April 2014). One important implication of the system of university classification and programme rankings is that it institutes a conditionality for organising master and doctoral studies, i.e., depending on the class of institution and the rank of the programme.

After the parliamentary elections in December 2012, the new government adopted a set of measures which also affect the RDI system. Thus, according to the Government Ordinance of 22.12.2012 the Ministry of Education, Research, Youth and Sport is reorganised by splitting into the Ministry of National Education and the Ministry of Youth and Sport, while the National Authority for Scientific Research (NASR) is dissolved, with all attributes taken over by the new Ministry of National Education (MNE). Furthermore, there is now a Delegate Minister for Higher Education, Scientific Research and Technological development within the MNE. Additionally, the different research institutes formerly subordinated to other ministries become subordinated to the new Ministry of National Education. These measures are expected to improve the representation of RDI in the government and also to reduce the variability of functional rules for the different national institutes.

The Government Ordinance 2010 which created *The Executive Agency for Higher Education, Research, Development and Innovation Funding* (UEFISCDI) by the unification of the previous three funding agencies is now subject of dispute. The movement to oppose the law approving the GO four years after its adoption and implementation has gained political support in the specialised commissions of the Parliament, despite the recommendation of the President and the protests of civil society organisations which suspect feudalisation of the R&D budget in an election year. The resolution of the conflict is still pending.

2.4. Recent Policy developments

The fiscal code was modified in January 2013 by the Government Ordinance 8/2013, among others increasing the deductibility of R&D expenditures from 20% to 50%. The deductible expenditure needs to be related to applied research or technological development relevant for the commercial activity of the company, the fiscal deduction being applied separately for each R&D project. For the application of the new rules, a procedure is still under public consultation.[8]

[7] The quality indicators (i.e. 17 composite indicators referring to teaching process, teaching staff, research etc) were used as a wave for the universities per student base financing. While theoretically they could represent up to 30% of the financing, given their large number and their rather contradictory influences, their real impact has been rather limited. (UEFISCDI, CNFIS 2013).

[8]

One of the contested issues of the new fiscal code is related to the fact that the fiscal deduction applies not only to R&D activities carried in Romania, but also in other states of the European economic area.[9]

The National RDI Strategy 2014-2020 and its main implementation instruments, the National RDI Plan 2014-2020 (NP3) and the Operational Programme, were in the phase of policy consultation in April 2014. The Strategy is announced for launch in May 2014.

Other relevant strategies in the process of elaboration are:

- The National Competitiveness Strategy 2014-2020 – also an ex-ante conditionality for Romania, meant as an umbrella strategy, but which had a rather unclear support in a period of very rapid changes of ministers and secretaries-of-state in the Ministry of Economy.
- The National Strategy for Export 2014-2020 – already available for consultation on the website of the Ministry of Economy[10]. The 140 pages document, similarly to the 2006-2009 version, represents a valuable analysis of industries and provides a large list of possible actions, but it barely mention the resources and mechanisms for achieving them.
- The National Strategy for SMEs – initially announced for public consultations for November 2013 by the Delegate Minister for Tourism and SMEs[11], seems not to be high on the agenda of the new delegate minister.
- The Strategic Framework for Tertiary Education, under development.

2.5. National Reform Programme 2013 and R&I

According to the COUNCIL RECOMMENDATION on Romania's 2013 national reform programme "R&D intensity is extremely low (0.48 % in 2011) and the efficiency and effectiveness of investment need to be substantially improved. Investors in R&D need to prioritise activities that have potential to attract private investment. Romania should also strengthen the intellectual property rights framework with a view to increasing the commercialisation of research results."[12]

2.6. Recent evaluations, consultations, foresight exercises

The "Analysis and Evidence Base of the R&D&I Market in Romania" (JASPERS/ARUP 2013) was launched in March 2013. Its "objective was not to set the priorities for Smart Specialisation in Romania, but to highlight areas of interest that can be analysed and investigated further, supported by the involvement of stakeholders and the development of a vision for innovation at a regional and national level". The study identified the following fields: Food and agriculture (based on employment, GVA and relatively significant research in both agriculture overall and biotechnology), ICT sector (telecommunications and software, based on clusters and publications); Engineering and technology (motor vehicles, other transport, electronics,

[9] http://www.hotnews.ro/stiri-esential-14102536-prevedere-controversata-codul-fiscal-ajutor-pentru-cercetare-sau-metoda-repatriere-profiturilor.htm

[10] http://www.minind.ro/strategia_export/SNE_2014_2020.pdf

[11] http://www.romania-actualitati.ro/in_noiembrie_va_fi_lansata_strategia_pentru_imm_uri-53703

[12] COUNCIL RECOMMENDATION on Romania's 2013 national reform programme and delivering a Council opinion on Romania's convergence programme for 2012-2016 (p.5-6) http://ec.europa.eu/europe2020/pdf/nd/csr2013_romania_en.pdf

machinery and equipment and technical textiles); and Energy and Environment (based on the investment in renewable energy and the environmental research) as holding potential interest.

Un updated version of the Evaluation of the National Strategy and of the National RDI Plan 2007-2013 (Technopolis 2012) has been elaborated as part of the project "The Elaboration of National Research, Development and Innovation Strategy 2014-2020" (Ionita et al. 2013).

In the period January-September 2013 a large foresight exercise was carried out as part of the project "Elaboration of the National Research, Development and Innovation Strategy 2014-2020" (www.cdi2020.ro) on two dimensions: the elaboration of the RDI Vision 2020 and the identification of the priorities (which include smart specialisation and the complementary priorities of public interest).

The consultations for the elaboration of the Vision on Romanian RTDI 2020 were carried in February-May 2013 and included four meetings of a 30-expert panel and a World Café event with more than 70 stakeholders' representatives.

The consolidated vision stresses the aim of increasing competitiveness along global values chains, based on a coherent innovation ecosystem. This Vision also sets out a set of principles for action along three main pillars: *business firms become key actors in innovation* (supported by fiscal incentives, IP regime, interfaces with the public sector); the *RTDI sector is a space of opportunity for the talented* (supported by international openness, access to infrastructures, education for creativity) and *breakthroughs in priority domains* (supported by long term programmes, international strategic partnerships, translational research, rewards for excellence).

Last but not least, the Vision document expresses a commitment to ensure, by the end of the strategic period: a public allocation for RDI of at least 1% of the GDP, to be doubled by another 1% from private funding; the establishment of a set of strategic research & innovation fields, to be supported through a package of concerted measures; the predictability of the system in terms of regulations, international standards, and competitive allocation procedures; the credibility of public-private partnerships in RDI; the closing of the researchers-per-capita gap with Europe.

Having as a preparatory input the ARUP/JASPERS sectoral analysis, the project "Elaboration of the National RDI Strategy 2014-2020" underwent a full-fledged foresight for smart specialization, which combined: a strong evidence base, a large online exploratory phase, a consolidation phase based on panels and an argumentative online consultation for the final selection of priorities.

A full-fledged foresight for smart specialization

To develop the ***evidence base,*** the project (www.cdi2020.ro) adopted a data analytics approach, combining a complex data repository and visualisation in the form of graphs and maps. For the "knowledge maps", there have been collected, cleaned, harmonized and analysed databases comprising: all publicly-funded competitive Romanian RDI projects over the last 7-8 years on different streams (over 6,000), all publications in the main scientific flows (over 100,000), all patents awarded over the past several years (7,000+), and data on more than half a million business firms. The resulting analyses led to the selection of 13 candidate fields of smart specialization and the identification of the corresponding experts and stakeholders.

For the ***exploratory phase,*** by end of June 2013 almost 30 thousand experts and stakeholders had been invited online to identify and support a subfield of specialisation with arguments regarding the challenge, R&D relevance, current state and future potential. They were also asked to recommend other relevant participants to the debate. Despite the relatively difficult requirements in argumentation, 1543 valid answers were received. The ideas expressed therein fed the next consultation phases.

In the ***focusing phase***, thirteen expert panels with a membership of around 15-20 each were put together. Within four days of face-to face interaction, each panel developed 6-8 micro visions for the most promising subfields they envisaged. The micro visions followed a template which included: the ambition of the subfield at the horizon 2020; arguments in favour or against selecting the field as a strategic RDI priority; the most promising research topics in the subfield; the currently available research resources; the resources needed in the near future so as to meet the subfield's ambitions by 2020; the relevant national economy; the results expected from RDI in the subfield by 2020 (provided the necessary resources are met).

The final ***selection phase*** was based on a broad online consultation following an adapted real-time Delphi 2.0 format. The invited experts and stakeholders were asked to evaluate the proposals of the panels along 6 criteria and also to select the most relevant arguments or provide new ones. By the end of the consultation, over 4,000 experts and stakeholders had responded to the questionnaire, the average number of respondents per subfield being 161. Using a multi-criterion approach approximately one third of the proposed priorities were selected and clustered in four smart specialisation priorities and three priorities of national interest.

The list of smart specialisations identified in the foresight exercise includes:

A1. BIOECONOMY

- Safe, accessible, nutritionally optimized food
- Sustainable development in forestry
- Zootechnics, veterinary medicine, fishing and aquaculture
- New products, practices, processes and technologies in horticulture
- Sustainable development of fields crops
- Bioenergy – biogas, biomass, biofuels
- Biotechnologies for agro-food
- Nanobiotechnology
- Environmental biotechnologies
- Industrial biotechnologies
- Bioanalysis
- Medical and pharmaceutical biotechnologies
- In vitro/ in vivo assessment for generic drugs
- Systemic, local and targeted drug delivery and technologies to optimize the biopharmaceutical and pharmacokinetic profile
- Molecular design, (bio)synthesis, semi synthesis, high-performance screening

A2. ICT

- Analysis, management and security of big data
- Future internet
- Software development technologies, instruments, and methods
- High performance computing and new computational models

A3. ENERGY AND ENVIRONMENT

- Increasing end-use energy efficiency
- Optimizing the use of conventional and non-conventional water resources
- Substitution of critical materials and functional covering

- The intelligent city

A4. ECO-TECHNOLOGIES

- New-generation vehicles and ecological and energy-efficient technologies
- Innovative technologies, equipment and technical systems for the generation of bio resources
- Depolluting and waste reuse technologies

In addition to the four smart specialisations, the foresight exercise identified three national priorities: Health, Space and Security, and Heritage and cultural identity.

2.7. Regional and/or National Research and Innovation Strategies on Smart Specialisation (RIS3)

Most of the results of the foresight exercise for the elaboration of the National RDI Strategy 2014-2020 were integrated in the final Strategy document (estimated to be launched in May 2014). Following a supplementary round of consultations with several national RDI institutes, several other fields were added to the final list of smart specialisations: a much larger emphasis on materials and especially nanomaterials, energy production (complementary to the energy efficiency) and a larger spectrum of space and security subfields. As a result, four smart specialisations have been aggregated[13]: (i) Bioeconomy; (ii) ICT, space and security; (iii) Energy, environment and climate change; (iv) Eco-nano technologies and advanced materials. In addition, the national priorities include: Health, Heritage and cultural identity and New and emerging technologies (the latter being more a framework for public procurement of innovation than a pre-determined set of technologies).

Regional Development Strategies have been developed by almost all regions, but, with a notable exception (that of the Region West, which used World Bank consultancy for building their strategy), most of these

- are based on an analysis of the current situation, but not on prospective knowledge (i.e., the drivers of change are not reflected in the identification of Threats and Opportunities in the largely adopted SWOT analysis).
- while relying on sectoral analysis, do not have a sectoral focus for innovation, and, in fact, no smart specialisation.
- refer to a generic form of support for innovation, but most action lines are not specific and implementation actors and funds are not clear.
- often refer to policies and investment in research capabilities and human resources, which are de facto of national competence.

Unless the regionalisation/decentralisation process is clarified, the entire capacity of the Regional development Agencies to coordinate such strategies remains a purely formal process. Currently, it is not at all clear even that the geography of the regions remains the same.

[13] The list of smart specialization has been already mentioned in the ROMANIAN PARTNERSHIP AGREEMENT FOR THE 2014-2020 PROGRAMMING PERIOD (March 2014)

2.8. Policy developments related to Council Country SpecificRecommendations

According to the Council Recommendation on 2013 National Reform Programme, Romania "needs to prioritize activities that have potential to attract private investment. Romania should also strengthen the intellectual property rights framework with a view to increasing the commercialization of research results."[14]

Both issues are now close to a solution: the prioritization of the research activities is taken care of as part of the National R&I Strategy 2014-2020, while a new law on the IPRs of employees is currently under debate in the Parliament.

[14] http://register.consilium.europa.eu/pdf/en/13/st10/st10649-re02.en13.pdf

3. PERFORMANCE OF THE NATIONAL RESEARCH AND INNOVATION SYSTEM

3.1. National Research and Innovation policy

Given that the number of researchers (FTE) per population is four times less than the EU average, for a reasonable comparison the productivity per researcher needs to be considered. Thus, the number of international scientific co-publication per researcher in Romania is double of the EU average, while the number of PCT patents per researcher is four times below the EU average.

Table 1

HUMAN RESOURCES	
New doctorate graduates (ISCED 6) per 1000 population aged 25-34	1.98 (2011) (EU average 1.52)
Percentage population aged 25-64 having completed tertiary education	20.4 (EU average 34.6)
Open, excellent and attractive research systems	
International scientific co-publications per million population	177 (EU average 343)
Scientific publications among the top 10% most cited publications worldwide as % of total scientific publications of the country	3.5 (2009) (EU average 11.)
Finance and support	
R&D expenditure in the public sector as % of GDP	0.30 (EU average 0.74)
Public Funding for innovation (innovation vouchers, venture/seed capital, access to finance granted by the public sector to innovative companies)	…
FIRM ACTIVITIES	
R&D expenditure in the business sector as % of GDP	0.12 (EU average 1.30)
Venture capital and seed capital as % of GDP	0.02 (EU average 0.29)
Linkages & entrepreneurship	
Public-private co-publications per million population	8.3 (EU average 52.8)
Intellectual assets	
PCT patents applications per billion GDP (in PPS€)	0.18 (EU average 3.9)
PCT patents applications in societal challenges per billion GDP (in PPS€) (climate change mitigation; health)	0.07 (EU average 0.96)
OUTPUTS	
Economic effects	
Medium and high-tech product exports as % total product exports High tech as % total exports Contribution MHT product export to trade balance	 6.3 (EU average 15.6) 0.38 (EU average 1.28)
Knowledge-intensive services exports as % total service exports	45.2 (2011) (EU average 45.3)
License and patent revenues from abroad as % of GDP	0.21 (EU average 0.59)

The number of ISI-indexed publications increased by 87% in the period 2007-2013, in association with the temporary improvement of project funding, the increasing importance of ISI publications for promotion in the academic career and the emergence of Romanian ISI-indexed publications. The proportion of publications in the young Romanian ISI journals reached its maximum in 2009 (44%) with a clear decreasing trend afterwards (32% in 2013).

Table 2: Number of journal articles with Romanian authors indexed in ISI-Web of Sciece during 2002-2013

Year	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
ISI-indexed	2,417	2,506	2,667	2,985	3,568	4,907	6,482	7,653	8,506	8,064	8,444	9,197
out of which in Romanian journals	444	551	557	746	921	1,683	2,660	3,356	3,490	2,991	2,710	2,946
Percentage of papers published in RO ISI journals	18%	22%	21%	25%	26%	34%	41%	44%	41%	37%	32%	32%

Data source: InCites, retrived April 2014.

The national patents have traditionally a very high proportion of physical persons as owners, a situation explainable both by the primarily reputational role of such patents and by the ambiguous IPR regime in Romania. However, the number of such patents has a clear descending trend, while the patents owned by universities and research institutes improved. Unfortunately, the number of patents granted to companies decreased by a factor of three in the last decade. (ERAWATCH 2012).

Table 3: Number of national patents by main owners 2001-2012

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Physical persons	591	377	599	423	461	528	282	327	391	307	223	216
Companies	252	159	205	156	210	174	153	110	140	89	97	88
Research institutes	50	38	28	24	36	33	31	55	137	62	67	90
Universities	29	14	20	14	14	6	4	18	66	89	87	83
Other	71	31	13	13	11	9	8	5	12	8	17	9
TOTAL	**993**	**619**	**865**	**630**	**732**	**750**	**478**	**515**	**746**	**555**	**491**	**486**

Data source: OSIM (ERAWATCH 2012)

Considering the need for the broad view, the draft R&I National Strategy 2014-2020 (NS) includes some elements which go beyond the current scope of MNE (e.g., public procurement for innovation, entrepreneurship) and which at present are not yet reflected in the active instruments coordinated by this ministry, but wait for other implementation frameworks.

For the policy cycle 2014-2020 four **smart specialisations** have been identified, in close connection with the economic and scientific potential:

- *Bioeconomy* – builds on the huge agricultural potential, the correlated food industry and the tradition in pharmaceuticals (correlated also with the wide availability of medical plants).
- *ICT* , *Security and Space* – ICT being one of the most dynamic industries in Romania.

- *Energy, Environment and Climate change* – with a stress on reducing energy dependency, increasing energy efficiency, management of water resources, and the intelligent city (which looks for integrated solutions in terms of energy, water, ICT for developing the old infrastructure of the Romanian cities).
- *Eco-Nano-Technologies and Advanced Materials* – which support the competitiveness of the significant automobile industry and the still-promising industry for agriculture equipment, but also depolluting and waste technologies (where Romania has to invest massively to reach EU standards), as well as new materials.

In addition, the NS envisages three fields of national interest (i.e., based on needs and not necessary relevant for commercialisation): *Health, Heritage and Cultural Identity* and *New and Emerging Technologies*.

NS includes a **monitoring system** with indicators highly compatible with the European Innovation Scoreboard and clear implementation responsibilities. However, all the targets for 2020 are conditioned by the evolution of public R&D expenditures.

The new strategy **does not restrict innovation to the technological kind**. Beside the fact that the priorities are formulated as challenges, dedicated financing lines in NP3 support problem-solving interdisciplinary projects at the initiative of the public sector (the funding line "Solutions") or the private one (the funding line "Innovation contracts").

The new strategy also promotes a more rigorous **multiannual budgetary planning** mechanism, but which remains vulnerable to the distortions triggered by the annual state budgets. The situation is somehow similar for the larger education budget, which should under the law receive 6% of GDP, but has been consistently below 4% so far.

The gradual rebalance of research to innovation:

- Co-financing schemes of private R&D investment exist in the current and new RDI Plan and SF Operational Programmes. Given the very low level of R&D budget and eliminating the funding for fundamental research, infrastructure, human resources and research with public benefit, few resources remained for such co-financing. An increase in the public R&D expenditure would in fact provide real room for co-financing privately initiated projects.
- The already adopted tax deduction of 50% may constitute a key driver for private investment. However, the one year delay in the release of the application norms (which also made the previous 20% deduction inapplicable) may discourage the SMEs in basing their strategies on such support measures.
- The partnerships have been the most common project format in Romania, starting with the Excellence Programme in 2005-2006 and the Partnerships programme in 2007-2013, and they will be most eligible in the new Plan and OP. However, the experience of partnerships between PROs and business supported by SF in the period 2007-2013 pointed to the still large cultural gap between the two sectors (indeed, under constrains of an over-bureaucratic funding system).
- In support of innovation, different instruments (e.g., vouchers for innovation) have been successfully introduced in the National Plan 2007-2013, but they remain limited because of the budget.
- The clusters are highly present in the national discourse, but they are predominantly simple agglomerations, very often with low technology intensity. The situation will probably improve only after regionalisation becomes a mature process.

- The rules for starting up and running a business are simple, but the creation of new companies is considerably lower than the EU average.
- Commercialisation has a substantially increased role in the programming period 2014-2020, a large part of the OP being dedicated to different instruments supporting it.

The mix of project and institutional funding

- The National RDI Plan and Operational programme 2007-2013 are full-project oriented. The next RDI Plan will include an institutional funding instrument addressed both to institutes and universities.
- The institutes are now periodically evaluated according to the law, but the results do not show a real dispersion and the connection with the institutional financing remains unclear.
- The classification of universities and the programme rankings have been abandoned.

Different project financing instruments in the NP3 and OP are open or even exclusive for the leading international talents. However, after the short period of budgetary increase (i.e., 2007-2009), the interest and the trust of the target group decreased dramatically.

The **tertiary education** has its own problems. The vocational formation is practically absent, as is the life-long learning, while the universities provide rather standard (and cheap) education with low interest for the employability of the graduates or for their entrepreneurship potential. The increasing gap with the labor market has only recently raised the concerns of the prospective students, more being interested in studying abroad. However, the quality of education remains high in S&T and medicine, fields where unfortunately the brain-drain is also very high.

3.2. Structural challenges of the national R&I system

1) *The RDI system is chronically underfinanced.* Not only the GBOARD is very low, it is also not compliant with the official targets, creating instability and unpredictability in the system, both for organisations and individuals. This also creates imbalance in the system between, for instance, the large investment in research infrastructure and human capital and the low financing of the projects afterwards.

2) The business sector is not innovation ready. The economy is dominated by multinationals, while the still young SME sector carries predominantly low value-added activities. Activating the business demand for RDI is not only an innovation policy issue, but needs to be seen in the context of a broader effort to support globalisation and the repositioning of Romanian companies in the value chain.

3) *Academic orientation of the research supply.* The increased ISI-publication represents in itself a success of a more clear validation mechanism (among others) for the otherwise autarchic RDI system. Publication was supported by certain financing mechanisms (e.g., the programme Ideas of the National RDI Plan 2007-2013), and the changing of the evaluations criteria for institutes and academic and research careers. This system is the only one that practically functions also when the RDI is underfinanced: in the universities (59% of ISI publication in 2011) people still need publications for academic career, the institutional funding for the Romanian Academy supports its mission related to fundamental research, while National R&D Institutes take also

refuge in this form of output in the absence of proper partnerships with the business sector. Fundamental research, although including world-class components, works also as a subsistence strategy in the Romanian RDI system.

For escaping this situation, most of the envisaged public expenditure increase needs to be focused on innovation oriented streams. The institutional R&D funding needs to be made more competitive (also among the three types of PROs) and differentiated by the form of output and validation mechanisms (e.g., fundamental research with validation in the international communities, applied research with market validation, and policy support research based on partnerships with relevant institutions).

4) *The public RDI system is fragmented.* A large number of PROs (39 research institutes, 109 universities, many research centres) having mostly a subsistence strategy populate the Romania RDI system, while at national level there are no strong anchors in terms of socio-economic objectives with proper political commitment to stimulate or impose a restructuring with a thematic (or any other form of) concentration. Hence, the main efforts are administrative, such as better evaluation, while the incentives for concentration remain low (e.g., the recent option for public institutes to join universities). The results are reflected also in the difficulty of achieving the critical mass for tackling smart specialisations or societal challenges in a multidisciplinary approach and for becoming real players at regional and global level.

5) *High brain-drain and not enough brain-circulation.* Despite the relatively low weight of tertiary education graduates in total population, the supply of PhDs and post-docs is much higher than the capacity of absorption in the public and private R&D organisations or in public institutions (in view of public procurement for innovation) under current settings. The efforts made for mobilising the diaspora[15] had only a very limited impact, given the uncertainties in funding, the high bureaucracy and the difficulties of access in PROs. (ERAWATCH 2012)

[15] www.romaniainoveaza.ro

3.3. Meeting structural challenges

Challenges	Policy measures/actions addressing the challenge [16]	Assessment in terms of appropriateness, efficiency and effectiveness
1. *The RDI system is chronically underfinanced.*	Strategic planning for 2014-2020 based on the assumed target of 1% GDP public expenditure.	The commitment for 1% is not reflected in the public budget for 2014 (and in the budgetary planning for 2015).
2. *Business sector is not innovation ready*	R&D tax deduction of 50% New instruments focused on companies introduced in the OP 2014-2020 (e.g., venture capital funds, credit guarantees).	The application procedure for the tax deduction is still pending. Additional policies supporting SMEs' internationalisation and repositioning in the global value chains are necessary for the activation of demand. The SMEs do not have a partner in the public sector. The innovation capacity of universities needs to be supported also. The deductibility for activities carried outside Romanian territory loses the stimulus for multinationals for locating R&D activities in Romania. It will take time for the venture capital culture to mature.
3. *Academic orientation of the research supply*	Concentration of resources on smart specialisations for 2014-2020 Introduction of demand-driven projects in the National Plan 2014-2020. A more clear segmentation of financed projects by the type of output (concept, prototype etc.)	Clarification and stabilisation of the financing mechanisms for universities is needed for some of these to adopt innovation-oriented strategies. Developing capacity for demand formulation in the public sector requires coordination at governmental level.
4. *The RDI system is fragmented*	Concentration of project-based financing in a limited set of priorities.	The selected priorities are calibrated for a 1% public R&D expenditure. If the commitment is not kept then the number of priorities should be further limited so as to make critical mass possible. Institutional concentration (and restructuring) in the PROs is needed for reaching critical mass and converging the structure with the priorities.
5. *High brain-drain and not enough brain-circulation*	Project financing schemes for international talents. More opportunities for PhD students to be involved in research projects.	The credibility of the Romanian Government for multiannual funding needs to be regained. The doctoral schools themselves need to be reoriented from education towards research.

Table 4. Assessment of policies tackling the challenges faced by the Research and Innovation System

[16] Changes in the legislation and other initiatives not necessarily related with funding are also included.

4. NATIONAL PROGRESS IN INNOVATION UNION KEY POLICY ACTIONS

4.1. Strengthening the knowledge base and reducing fragmentation

Promoting excellence in education and skills development

The number of researchers (FTE) per population is four times below EU28 average. The structure is also unbalanced: only 23% researchers in the business sector in 2011 compared with the EU28 average of 45% (Eurostat). That is why the draft RDI Strategy for 2014-2020 sets the objective of doubling the number of researchers by 2020, with a structural target of 45% in the business sector.

This increase needs among others a considerable supply of human resources. Romania has already invested a lot in doctoral and post-doctoral studies in the last years, but additional efforts are to be made in order to connect the doctoral studies and the research activities.

The long-term underfinancing has already determined a substantial brain-drain, Romania having among EU countries one of the largest scientific diasporas, with an estimated 15,000 researchers working abroad (World Bank 2011, p21). While the doctoral schools (funded by Structural Funds (SF)) provided generous financial support for its students[17], they already experience difficulties in finding relevant jobs in Romania, becoming candidates for further enlarging the diaspora.

As universities do not receive block funding for research, the research activity in this sector fully relies on success in project competition. Given the considerable fluctuations in project financing, research activities in universities are a rather temporary and a complementary activity to teaching.[18]

The higher education market is undergoing a dramatic change. On the one hand, the higher education has been confronted with a substantially decreasing cohort of students given the new standards for secondary-level graduation, the *bacalaureat* (a 46% graduation rate in 2011, 43% in 2012 and 56% in 2013 compared to rates of over 80% only 4 years ago). On the other hand, the demand for quality increased, the interest in labor market relevance increased, as did the interest in studying abroad. Under these circumstances many universities and especially the private ones, which in Romania focused on mass education, are facing restructuring.

Government Ordinance 92 of 18.12.2012 changes some of the elements of the law of education, drastically reducing some of the restrictions for academic staff: eliminates the age limit (i.e., the retirement age for professors and rectors); eliminates the restriction of maximum 8 PhD students per professor; eliminates the conflict of interest in simultaneously holding a position in the public administration and the position of rector; eliminates the compulsory role of the accreditation procedure (*habilitation*) for conducting PhD theses.

[17] The PhD scholarships supported "Operational Programme Development of Human Resources" registered considerable delays (up to 6 month), creating real difficulties for the students dependent of these funds, especially in the periods of international mobility.

[18] However, given the importance of the publication for the academic career, the scientific production of the public universities is rather high, exceeding by far the one of the Romanian Academy or the national research institutes.

The participation of foreign researchers in projects is encouraged, conditional on a contract with a Romanian host institution. The foreign researchers can be project coordinators, as it is the case for "Complex exploratory research" (up to 5 mil. euro per project) financed under the National RDI Plan 2007-2013; or with the scheme "R&D projects with foreign participation" financed by structural funds for the same period.

The Euraxess Romania portal (www.euraxess.gov.ro) supports Romanian and foreign researchers seeking a job in Romania, provides information regarding the procedures for obtaining visas, residence and labour permits, provides information on taxation of research activities and the regime of intellectual property rights in Romania.

Publication of job vacancies in Euraxess is not yet a regular practice in Romania, however. Furthermore, it is difficult to assess its visibility in this period when employment in public research is very limited. This happens in the context of low inter-institutional mobility at national level, in both institutes and universities.

Nevertheless, in order to increase the visibility of the recruiting system provided by EURAXESS portal, the publishing of research vacancies/openings has been introduced in the national competitions under the NP2.

Presently, nine Romanian institutions (5 public universities, 3 national R&D institutes and 1 private university) signed the Declarations of endorsement for the Charter & Code.

Research Infrastructures

Romania is part of ten pan-European infrastructures projects: Extreme Light Infrastructure – ELI, Facility for Antiproton and Ion Research – FAIR, Production and study of rare isotope radioactive beams – Spiral2, Underwater Neutrino Observatory – KM3NET, European Bio-Banking and Biomolecular Resources – BBMRI, ERICON – Aurora Borealis, Research Infrastructures Network for Research in Biodiversity – LIFE WATCH, European Multidisciplinary Seafloor and Water Column Observatory – EMSO.

The Extreme Light Infrastructure – Nuclear Physics (ELI-NP) is a pan-European infrastructure which will be built in Romania. In December 2012 the contract for the first stage of the investment (€180m) was signed between the National Authority for Scientific Research and the National Institute of Physics and Nuclear Engineering. Access to the ELI-NP will be granted for most of the eligible time based on evaluation of the scientific cases by the international scientific board.

The scientific case for "Danube International Centre for Advanced Studies for Rivers-Deltas – Sea Systems" (Danubius-RI) has been drafted by an international group of scientists and stakeholders. Its intermediary version is available, but it will evolve in the near future as the concept of Danubius–RI, i.e., a concept closer to a world class pan-European distributed research infrastructure (see www.danubius-ri.ro).

4.2. Getting good ideas to market

Improving access to finance

The JEREMIE Fund (€100m) is the largest financial instrument implemented in 2007-2013. Although approved in 2008, it was not until 2011 that the first financial intermediaries were contracted for the "Portfolio Guarantee" product (€68m) which had in June 2013 an estimated portfolio of around €160m. The €17.5m Catalyst Fund providing risk capital made its first investment in June 2013. However, microfinance initiatives have so far been more successful than other financial instruments. Experience has also highlighted the negative impact of the

reimbursement on investment model, which resulted in approved investment projects not moving forward (Romanian Partnership Agreement For The 2014-2020 Programming Period, Draft September 2013, p. 17).

In August 2012, a new set of innovation support instruments were launched under the National RDI Plan, namely: Support for high-tech export (which received 8 applications and has an estimated increase by a factor of 3.7 in high-tech export compared to the public contribution); Development of products, systems and technologies, having received 88 applications cumulating over €45m; and Vouchers for innovation (UEFISCDI 2012). The explicit general policy of the National Council for Development and Innovation is to increase pressure for the delivery of higher socio-economic impact. The policy is reflected in: new eligibility criteria related to patents and RDI patent returns; higher weights of the socio-economic impact criteria in the evaluation, reaching 55% in certain calls; bonuses for high returns from innovative goods and services (Talpes 2012).

For the period 2014-2020, the commercialisation component is regarded as a priority. The main instruments in the draft Operational Programme in this respect include: access to risk capital for SMEs, credits with subsidised interest rates and guarantees for credits.

Protect and enhance the value of intellectual property and boosting creativity

The State Office for Inventions and Trademarks (OSIM) is providing a service of pre-diagnosis for companies free of charge. The service consists in the identification of the potential of intellectual property based on a discussion with the manager and a visit at the company headquarters. The resulting study includes practical recommendations for the company in view of maximising the economic benefits of the intellectual property (www.osim.ro).

A Law project for employees' inventions underwent public debate in 2013. In the form adopted by the Senate in November 2013 (still to be validated by the Chamber of Deputies) is only partially resonant with the complaints of the multinationals regarding previous IP conflicts with their Romanian employees.

The National Strategy for Intellectual Property Protection 2012-2015 remains a proposal.

Public procurement

Currently public procurement of innovative goods and services is not included in the national practices. The draft R&I Strategy 2014-2020 stresses the importance of enhancing both public procurement for innovation and pre-commercial procurement.

4.3. Working in partnership to address societal challenges

Romania is participating in six JPIs: "Healthy and Productive Seas and Oceans", "Cultural Heritage", "Agriculture, Food Security and Climate Change", "A Healthy Diet for a Healthy Life", "Antimicrobial Resistance", "Water Challenges for a Changing World".

Other international collaboration programmes include:

- The Switzerland-Romania cooperation programme 2011-2016. Based on the agreement between the Romanian Government and the Swiss Federal Council from November 2010, the programme includes: thematic research calls (Cancer, cardiovascular diseases, diabetes and obesity; Impact of waste and pollutants on environment and climate;

Sustainable energy; Economic growth and social disparities) with a total value CHF 10.35m (85% Swiss contribution, 15% Romanian contribution from the Ideas programme) and doctoral and post-doctoral scholarships (total value CHF 6.68m).

- The cooperation programme Romania-Norway, Iceland, Liechtenstein, under the SEE Financial Mechanism 2009-2014. The programme supports joint research projects (with a budget of €20m from the donor countries and 15% co-financing from the Romanian part). The thematic areas for this programme are: (a) Climate change and renewable energy; (b) Health and food safety; (c) Environmental protection and management, (d) Social sciences and economics.

- The framework for research collaboration between Romania and France, which supports joint research projects in the fields of Physics, Environment, Chemistry, Mathematics.

Romania is also participating in 5 Joint Technology Initiatives (JTIs): "Clean Sky" (aeronautics), ENIAC (nanotechnology), "Fuel Cells" (energy), ARTEMIS (embedded systems), IMI (health).

4.4. Maximising social and territorial cohesion

The four smart specialisations at national level for 2014-2020 build on the huge agro-food potential of the country, the fast growing ICT industry, the demand for eco-efficiency and the industrial capacity in vehicles, machinery and equipment.

Smart specialisation is understood in the National R&I Strategy 2014-2020 as a gradual process having as main driver the public-private partnership for innovation and entrepreneurship.

4.5. 4.5. International Scientific Cooperation

Internationalisation represents a priority in the National R&I Strategy 2014-2020 and a strong emphasis is given to attracting principal investigators from all over the world (whether members of Romanian diaspora or not). However, trans-Atlantic mobility is not a specific target. [19]

Romania contributes to 16 international organisations: International Centre for Genetic Engineering and Biotechnology (ICGEB, Trieste), International Seismological Centre (Newbury, UK), European Physical Society (Geneva), International Centre for S&T Information (Moscow), EUREKA, ESF (Strasbourg), COST, TERENA (Amsterdam), CEENET (Austria), EUROGEOSURVEYS, European Space Agency (ESA), ITER, GSI-FAIR GmbH, CERN, Unified Centre for Nuclear Research (Dubna) and SCAR. The contribution amounts to €25m per year, the largest contribution being to ESA (€16m) and CERN (€6m).

[19] The bilateral agreement between the US Office of S&T Cooperation, the Bureau of Oceans and International Environmental and Scientific Affairs (OES/STC) and the Romanian National Authority for Scientific Research was signed in 1998 and has been active since 2000, but its actual implications are rather difficult to observe.

5. NATIONAL PROGRESS TOWARDS REALISATION OF ERA

5.1. More effective national research system

The R&D public expenditures remain below 0.3% despite the official target of 1% established in 2006 for 2010, and recently renewed for 2020. The National RDI Plan 2007-2013 received only a third of the programmed allocation. This situation resulted in the continuation of the brain-drain and adoption of stand-by strategies for the research organisations. The lack of predictability also affected the system in structural terms, e.g., the investment in research infrastructure has not been complemented by relevant resources for projects, while the large number of PhDs supported by SF did not fund opportunities for a research career.

BERD further decreased to a mere 0.12% in 2012. The implementation of the 50% tax deduction for R&D expenditures may reverse the BERD trend, but given the structure of the economy the latter cannot increase very much in the absence of a solid public R&D sector.

Institutional block funding as such is received by the Romanian Academy (18% of the public budget in 2013), which distributes it among its institutes based on internal rules and national R&D institutes through programme Nucleu (13% of the public budget in 2013). The institutional financing of the national R&D institutes needs to be directly correlated with the results of their international evaluation.

5.2. Optimal transnational co-operation and competition

Romania is participating in six JPIs, all connected with the smart specializations or the national priorities identified for 2014-2020: with Bioeconomy ("Healthy and Productive Seas and Oceans", "Agriculture, Food Security and Climate Change"), Energy and Environment (which particularly envisages "Water Challenges for a Changing World"), Heritage and national identity ("Cultural Heritage"), and Health ("A Healthy Diet for a Healthy Life", "Antimicrobial Resistance").

The current participation in the five JTIs is also relatively connected with the future priorities: IMI (health) is a clear priority, "Clean Sky" (aeronautics) fits in the eco-transport technologies, ENIAC (nanotechnology) and ARTEMIS (embedded systems), in the new form of ECSEL, are supported by the *ECO-Nano-Technologies and Advanced Materials* priority and *ICT* priority, while "Fuel Cells" is supported by the *Energy, Environment and Climate Change* priority.

Romania also has three undergoing bilateral partnerships, and it is also part of ERA.Rus.

Romania has decided to allocate a large budget for the development of ELI-NP in Magurele near Bucharest, being a pioneer in the use of structural funds for investing in a pan-European research infrastructure.

The draft R&I Strategy 2014-2020 and its main implementation instruments introduce:

- Support for participation in Horizon *2020* projects.

- Coordinated participation in European initiatives – *Joint Programming Initiatives*, *Joint Technology Initiatives* (JTI) / *European Innovation Partnerships* (EIP) – and collaboration with tertiary countries (ERA-RUS, ERA-LAC).
- Support for participation in international organisations (CERN, ESA etc.) on the basis of an integrated participation plan.
- Funding bilateral appeals.
- The creation of synergies with European Union programmes in RDI that are centrally managed via *twinning* and *teaming* projects (on the level of emerging excellence centres, innovative regions, innovation clusters in both Romania and the EU) (through PO Competitiveness).
- Founding endowed chairs (modelled after the *ERA chairs*) in order to attract researchers or lecturers of renown.

5.3. An open labour market for researchers

The supply of human resources in Romania exceeds the capacity of absorption by the traditionally underfinanced R&D system. Hence, Romania has, among EU countries, one of the largest scientific diasporas, with an estimated 15,000 active researchers working abroad (World Bank 2011, p.21). While the new doctoral schools (funded by Structural Funds (SF)) provided generous financial support for its students, the latter already experience difficulties in finding relevant jobs in Romania, becoming candidates for further enlarging the diaspora.

The inter-institutional mobility at national level is quite reduced, in both institutes and universities. Very often an academic advances in career in the university she/he graduated. This organizational culture in both institutes and universities makes the recruitment often an internal affair, despite formal compliance with the steps of the procedure.

The draft R&I Strategy 2014-2020 and its main implementation instruments introduce:

- The obligation to publish vacancies in PROs in Euraxess and to adhere to the European Researcher Charter and Code;
- A spectrum of financing instruments dedicated to attracting leading international talents;
- The first Romanian fellowship programme;
- The National Registry of Researchers.

5.4. Gender equality and gender mainstreaming in research

The employment in R&D sector is relatively balanced by sex (46% women in 2011, National Institute for Statistics data). In 2009 Romania had 45% women in R&D, while EU average was only 33% (She knows 2012). The proportion of female PhD (ISCED 6) graduates in 2010 was 48% in Romania, compared to 46% EU27 average, while the proportion of female academic staff grade A of 36% in Romania is substantially above the 20% EU27 average (She knows 2012). Gender statistics about the top positions in research organisations are not available yet.

In addition to maternity leave, Romania has one of the longest child care leaves in Europe. According to the law 111/2010 amended by Governmental Ordinance 124/2011, the child leave is granted to one of the parents under two options: 1 year with a level of 85% of net average income in the previous 12 months period, with a minimum value of €140 and a maximum of €800; or 2 years with the same provisions except for the maximum limit of only €280. The parent is also encouraged to return to work: if the person returns to work before the end of the 12th month, she/he will receive a stimulus of €140 per month up to the end of the second year.

5.5. Optimal circulation, access to and transfer of scientific knowledge including via digital ERA

Technological transfer, while present in most declarative documents, has an underdeveloped infrastructure and requires major investment especially in human resources development. The public research funding strongly encourages publication of results, but not necessary under an open access regime. However, an important financial effort has been made to provide free-of-charge online access to a large spectrum of scientific literature for PROs.

The draft R&I Strategy 2014-2020 and its main implementation instruments introduce:

- Support action for developing adequate skills for technology transfer;
- A shift in the cluster support policies from state leadership to support of the private initiative;
- Encouraging the gold open access standard for publishing the results of publicly-financed research.

Annex 1. PERFORMANCE IN THE NATIONAL AND REGIONAL RESEARCH AND INNOVATION SYSTEM

Feature	Assessment	Latest developments
1. Importance of the research and innovation policy	(-) The coordinating body at governmental level (i.e. The National Council for Science and Technology Policy – NCSTP) has no registered activity yet. (-) Research and innovation is trapped in a vicious circle: the chronic underfinancing restricts the RTDI system to academic production, and the low economic impact maintains the public perception that the sector is a user of resources rather than a driver of growth.	(+) According to the draft R&I Strategy 2014-2020 NCSTP is being reorganised, taking the innovation component under its remit – becoming The National Council on Science & Technology Policy and Innovation and being placed under the direct supervision of the Prime Minister. The council will include representatives from ministries from research entities, and from the business world. (-) Romania has allocated from structural funds 2014-2020 only €700m for research and innovation, amount representing only 10% of the targeted public R&D expenditures for the period.
2. Design and implementation of research and innovation policies	(+) For 2007-2014 Romania has a National R&I Strategy and a National RDI Plan which include a large spectrum of instruments for supporting research and innovation. (-) The allocated budget for the National RTDI Plan 2007-2013 represented only one third of the programmed one.	(+) The draft National R&I Strategy 2014-2020 and its main implementation instruments (National RDI Plan and RDI Operational Programme) include a limited set of priority fields connected to smart specialisation and national needs, priorities identified in a procedure combining evidence base and stakeholders participation. (+) The National R&I Strategy 2014-2020 includes a monitoring system with indicators highly compatible with the European Innovation Scoreboard.
3. Innovation policy	(-) In the last decade the RDI policy has only been the responsibility of the National Authority for Scientific Research, which could *de facto* promote just R&D related policies and only marginally broader innovation elements as well.	(+) The National R&I Strategy 2014-2020 and its main implementation instruments have an increased focus on innovation. (+) In the new strategic framework, co-financing based instruments have a considerable weight. (+) The draft National RDI Plan and OP 2014-2020 have clear innovation support mechanisms and a communication programme for the promotion of research and innovation in society.
4. Intensity and predictability of the public investment in research and innovation	(-) The public R&D expenditures remain below 0.3% of GDP despite the 1% target assumed in 2007 for 2010 and its recent renewal for 2020. (-) Multiannual planning is distorted by annual budget changes, leading to cuts in projects already underway and delays of competitions.	(-) The targeted public expenditure for R&D by 2020 is already not reflected in the public budget for 2014 and estimates for 2015. (-) Reaching the 1% target for public expenditure is unlikely, given that only 10% of the funds for 2014-2020 can be covered from the allocated structural funds for R&D. (+) The (likely) adoption of the National RDI Strategy 2014-2020 and its main implementation instruments attempts to put in place more predictable financing mechanisms based on a more rigorous multi-annual budgetary planning. (-) The total budget for education remains low and the 6% of GDP minimum allocation has been

		abandoned.
5. Excellence as a key criterion for research and education policy	(+) The National RDI Plan 2007-2013 was composed mainly of competitive project-based funding with established evaluation criteria. (-) The universities do not receive institutional funding for research. (-) The PhD programmes still have rather weak connections with R&D activities.	(-) The classification of universities and the ranking of academic programmes have been abandoned. (+) The RDI Strategy 2014-2020 provides for a performance-based institutional funding for all PROs, thus including universities.
6. Education and training systems	(-) Entrepreneurial skills are only occasionally developed in higher education. (-) E-learning, blended learning and more generally the format of education programmes are overregulated (following cases of abuse), which constrains the capacity to experiment and innovate. (-) Participation in lifelong learning is at one of lowest levels in Europe.	(+) The minister of national education announced that the financing will be ended for specialisations not relevant for the labor market. (+) The credibility of secondary education graduation exam (i.e., *bacalaureat*) has been regained after several years of video supervision.
7. Partnerships between higher education institutes, research centres and businesses, at regional, national and international level	(+) Projects in partnership between different actors have been highly supported under the National RDI Plan 2007-2013. (-) Few partnerships go beyond the project time frame. (-) The business sector is still underrepresented in partnerships, mainly due to a still low interest in developing RDI activities.	(+) In the National RDI Plan and Operational Programme 2014-2020 the partnerships are supported in different formats, including on medium term (5-7 years).
8. Framework conditions promote business investment in R&D, entrepreneurship and innovation	(+) Tax deduction of R&D expenditure has been introduced in 2010 and raised to 50% in 2013. (-) The still missing application norms for the tax deduction scheme renders it inapplicable for the time being.	(+) A new law regarding the IPR for employees' inventions partially reduces the possible conflicts between companies and employees on IPR.
9. Public support to research and innovation in businesses is simple, easy to access, and high quality	(-) Bureaucracy, lack of trust and delays in payments characterised all the structural funds allocation mechanisms in the period 2007-2013. (+) The National RDI Plan 2007-2013 implementation mechanisms are highly compliant with FP7 good practices.	
10. The public sector itself is a driver of innovation	(-) The use of public procurement of innovative products and services as a key innovation promoter is still far from being a usual practice in Romania.	(+) The National Strategy and Plan 2014-2020 have introduced dedicated instruments for encouraging the activation of the public sector demand. (-) The regionalisation process has been delayed.

Annex 2. NATIONAL PROGRESS ON INNOVATION UNION COMMITMENTS

		Main changes	Brief assessment of progress / achievements
1	Member State Strategies for Researchers' Training and Employment Conditions	(-) The limited national budget for R&D in 2013 caused cuts in the budget for projects already underway and delays for new calls. The research career is still a very uncertain one. (+) The salary cuts in the budgetary sector of 25% introduced in 2010 have been gradually eliminated. (+) The draft National R&I Strategy 2014-2020 sets the objective of doubling the number of researchers by 2020, simultaneously with having 45% of researchers from the business sector. (+) The draft National R&I Strategy 2014-2020 provides for the adoption of the Charter and Code and the implementation of HRS4R in all PROs.	(-) The number of researchers per population is at a quarter of EU average (-) Several provisions of the Education law regarding doctoral studies have been cancelled, i.e., the restriction of maximum 8 PhD students per professor; the compulsory role of the accreditation procedure (habilitation) for conducting PhD theses. (+) Large number of doctoral and post-doctoral scholarships using structural funds (-) Few adopters of researchers' Charter and Code (-) Delays in payments for the PhD and post-doc scholarships. (-) PhD is still insufficiently connected to research.
4	**ERA Framework**		
5	**Priority European Research Infrastructures**	(+) Construction of ELI-NP started.	(+) Romania allocated 280m€ from SF for the pan-European infrastructure ELI-NP in Magurele near Bucharest. (+) Romania is part of ten pan-European infrastructures. (-) The research activities related to some of the RIs to which the country contributes are underdeveloped.
7	**SME Involvement**	(+) Tax deduction for R&D activities has been increased from 20% to 50%. The implementation procedure is still under elaboration. (-) The new tax deduction applies even for R&D activities not carried out on Romanian territory – reducing the incentive for locating R&D activities in the country. (+) The draft Strategy, Plan and Operational Programme 2014-2020 provide for a battery of instruments	(+) A new set of innovation support instruments was launched in 2012 under the National RDI Plan 2007-2013, namely: Support for high-tech export; Development of products, systems and technologies; and Vouchers for innovation. (-) Romania allocates a very small part of SF to RDI activities, thus limiting the actual support for SMEs.

		to increase SMEs' involvement and in support of commercialisation.	
11	**Venture Capital Funds**	(+) JEREMY Fund made first investment in June 2013 (+) A risk capital fund is provided for in 2014-2020 under the RTDI Operational Programme.	(-) Very weak presence of venture capital.
13	**Review of the State Aid Framework**	(+) The principle "first come, first served" used before October 2013 for *de minimis aid* has been replaced by an evidence-based evaluation procedure. [20]	
14	**EU Patent**	(+) Romania ratified the Unitary Patent in February 2013.	
15	**Screening of Regulatory Framework**		(-) No screening activities for the Regulatory Framework.
17	**Public Procurement**	(-) No target yet for public procurement of innovative goods and services. (+) Pre-commercial procurement provided for under the National R&I Strategy 2014-2020.	
20	**Open Access**	(+) Open access to results from publicly funded research is set as a principle in the draft Strategy R&I 2014-2020.	(+) The free access to international scientific publications for a set of PROs is provided by the online platform www.anelis.ro (+)Romanian journals are also supported by the editorial platform www.scipio.ro
21	**Knowledge Transfer**	(+) The RDI Operational programme 2014-2020 supports projects of technological transfer.	(-) The activities of the network for innovation and technological transfer (ReNITT), with its 45 accredited entities, are still rather modest
22	**European Knowledge Market for Patents and Licensing**		(-) The number of PCT patents in Romania is only 4% of EU average.
23	**Safeguarding Intellectual Property Rights**	(+) Law proposal for clarification of IP for employees.	
24	**Structural Funds and Smart Specialisation**	(+) Smart specialisation at national level is part of the draft National R&I strategy 2014-2020. (+) Regional smart specialisations strategies, but without proper governance models.	
25	**Post 2013 Structural Fund Programmes**	(+) The RDI Operational Programme is in a final draft, being elaborated in correlation with the National RDI Strategy and Plan 2014-2020.	

[20] http://www.tion.ro/firmele-vor-primi-ajutor-de-minimis-dupa-criterii-clar-stabilite/1349358

26	**European Social Innovation pilot**		(-) No relevant action
27	**Public Sector Innovation**	(+) The National R&I Strategy 2014-2020 includes a set of specific RDI priorities for the public sector (Health, Heritage and Cultural Identity, and New and Emerging Technologies) and supports pre-commercial procurement.	
29	**European Innovation Partnerships**	(+) The Danube Innovation Partnership was launched in Bucharest on 29th October 2013	
30	**Integrated Policies to Attract the Best Researchers**	(+) The coordinators of projects financed through the National Plan can be foreigners hosted by a Romanian institution.	(-) The reduction of public funds and the cuts of projects already under way limited the attractiveness for international talents.
31	**Scientific Cooperation with Third Countries**	(+) Romania is participating in ERA.Net RUS.	
32	**Global Research Infrastructures**		(+) Romania is contributing to Unified Centre for Nuclear Research in Dubna, (Russia) €1.57m per year.
33	**National Reform Programmes**		

Annex 3. NATIONAL PROGRESS TOWARDS REALISATION OF ERA

ERA Priority	ERA Action	Recent changes	Assessment of progress in delivering ERA
1. More effective national research systems	Action 1: Introduce or enhance competitive funding through calls for proposals and institutional assessments	(+) The draft RDI Plan and Operational Programme 2014-2020 envisage almost exclusively competitive funding. (-) The process of classification of universities and ranking of academic programmes has stops and goes.	(+) The National RDI Plan and the Operational Programme 2007-2013 had a clear competitive project funding approach. (-) The National RDI Plan 2007-2013 received only one third of the programmed financing, limiting the project funding available in the system. (-) There is no strategic framework for the research financed by the Romanian Academy. (-) Institutional assessment remains rather formal, with a still unclear relationship to institutional financing. (-) Institutional R&D funding is not available for universities.
	Action 2: Ensure that all public bodies responsible for allocating research funds apply the core principles of international peer review	(+) The draft RDI Plan 2014-2020 relies on international peer review as a key principle.	(+) In the implementation of the National RDI Plan and of the Operational Programme 2007-2013 the principles of international peer review have been fully implemented. (-) The NUCLEU programme supporting the National R&D Institutes is not correlated with the institutional evaluations.
2. Optimal transnational co-operation and competition	Action 1: Step up efforts to implement joint research agendas addressing grand challenges, sharing information about activities in agreed priority areas, ensuring that adequate national funding is committed and strategically aligned at European level in these areas	(+) The draft National RDI Plan 2014-2020 through the "International" programme supports the participation in JPIs, JTIs, large international projects, twinning projects with laboratories from EU and OECD countries.	(+) Romania is part of most 5 JTIs. (+) Romania is part of 16 large international research projects.

	Action 2: Ensure mutual recognition of evaluations that conform to international peer-review standards as a basis for national funding decisions		
	Action 3: Remove legal and other barriers to the cross-border interoperability of national programmes to permit joint financing of actions including cooperation with non-EU countries where relevant	(+) Romania is participating in ERA.Net RUS	(+) Romania has several bilateral programmes. (+) Romania is part of 16 international organisations.
	Action 4: Confirm financial commitments for the construction and operation of ESFRI, global, national and regional Ris of pan-European interest, particularly when developing national roadmaps and the next SF programmes	(+) The concept of the Centre for Advanced Studies on Rivers-Deltas-Sea Systems is evolving towards a pan-European distributed RI.	(+) Romania has decided to allocate a large budget for the development of the pan-European infrastructure ELI-NP in Magurele near Bucharest, being a pioneer in the use of structural funds for investing in a pan-European research infrastructure. (+) Romania is part of ten pan-European infrastructures.
	Action 5: Remove legal and other barriers to cross-border access to RIs	(+) The National Registry of Research Infrastructures is under development.	(-) The access to many RIs remains limited (both nationally and internationally) in the absence of a National Registry of Research Infrastructures.
ERA priority 3: An open labour market for researchers	Action 1: Remove legal and other barriers to the application of open, transparent and merit based recruitment of researchers	(+) The draft R&I Strategy 2014-2020 provides for the obligation of PROs of announcing vacant jobs in Euraxess.	(-) The framework for merit-based recruitment is hampered by organisational culture and by the low visibility of job vacancy postings.
	Action 2: Remove legal and other barriers which hamper cross-border access to and portability of national grants	(+) The draft RDI Plan and Operational Programme 2014-2020 include specific measures to attract senior researchers from abroad.	(+) The participation of foreigners as project coordinators is highly encouraged in the National RDI Plan 2007-2013.
	Action 3: Support implementation of the Declaration of Commitment to provide coordinated personalised information and services to researchers through the pan-European EURAXESS3 network		(-) The network of committed local contact points (LCP) must be further developed/ enlarged. The LCP assist researchers from their own institution (incoming/outgoing) and keep the relevant statistics. They could be hosted by universities, research

			organizations, other economic actors.
	Action 4: Support the setting up and running of structured innovative doctoral training programmes applying the Principles for Innovative Doctoral Training.	(+) The draft National RDI Plan 2014-2020 provides for the possibility of having vacant PhD places in accepted projects, in order to enable the initiation of PhD topics in relation with R&D projects.	(-) The links between the PhD programmes and research & innovation are underdeveloped.
	Action 5: Create an enabling framework for the implementation of the HR Strategy for Researchers incorporating the Charter & Code	(+) The draft National R&I Strategy 2014-2020 provides that the HR Strategy, Charter and Code are mandatory in all PROs.	(-) Only few organisations adopted the HR Strategy.
ERA priority 4: Gender equality and gender mainstreaming in research	Action 1: Create a legal and policy environment and provide incentives	No relevant measures	(+) The gender balance in the Romanian R&D system is substantially better than the EU average.
	Action 2: Engage in partnerships with funding agencies, research organisations and universities to foster cultural and institutional change on gender	No relevant measures	
	Action 3: Ensure that at least 40% of the under-represented sex participate in committees involved in recruitment/career progression and in establishing and evaluating	No relevant measures	
ERA priority 5: Optimal circulation, access to and transfer of scientific knowledge including via digital ERA	Action 1: Define and coordinate their policies on access to and preservation of scientific information	(+)The draft National RDI Strategy 2014-2020 provides for the adoption of the gold open access standard for publications resulting from publicly funded research.	(+) Access to scientific literature for PROs is provided by the ANELIS platform. (+) The platform for supporting the editing of Romanian journals is functional. (-) There is no functional system for the preservation of scientific information.
	Action 2: Ensure that public research contributes to Open Innovation and foster knowledge transfer between public and private sectors through national knowledge transfer strategies	(+) The draft National RDI Strategy 2014-2020 and its main implementation instruments support capacity development for technology transfer.	(-) The current tech transfer infrastructure is not delivering as initially expected.
	Action 3: Harmonise access and usage policies for research and education-related public e-infrastructures and for	No relevant measures	

	associated digital research services enabling consortia of different types of public and private partners		
	Action 4: Adopt and implement national strategies for electronic identity for researchers giving them transnational access to digital research services	(+) The adoption of electronic identity for researchers is provided for in the National RDI Strategy 2014-2020.	

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LIST OF ABBREVIATIONS

CNFIS	National Council for Higher Education Funding
IMF	International Monetary Fund
MNE	Ministry of National Education
NIS	National Institute of Statistics
NP3	National RDI Plan 2014-2020
OSIM	State Office for Inventions and Trademarks
RDI	Research, development and innovation
SF	Structural funds
NS	National Strategy for Research, Development and Innovation 2014-2020
UEFISCDI	Executive Agency for Higher Education, Research, Development and Innovation Funding

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